

Nothing you do for children is ever wasted.

Garrison Keillor

CANCER

Strong Signal for Cell Phone Effects

With 3 billion cell phone users worldwide and more than 260 million in the United States alone—among them 46% of U.S. children aged 8–12, according to Nielsen Mobile figures released 10 September 2008—human exposure to low-energy radiation in the 800- to 2,000-megahertz range is at an all-time high. The most recent attempt to systematically review the epidemiologic evidence for increased risk of brain tumors related to cell phone use indicates that repercussions from this global experiment are coming to light. In a meta-analysis published in the May 2008 issue of the *International Journal of Oncology*, Swedish researchers found significant associations between long-term cell phone use and brain tumor risk.

“We found that cell phone use is linked to gliomas [malignant brain tumors] and acoustic neuromas [benign tumors of the brain’s auditory nerve] and are showing up after only ten years,” says lead author Lennart Hardell, an oncologist and cancer epidemiologist at University Hospital in Örebro, Sweden. Specifically, for studies that included at least 10 years of exposure, there was a doubling in the risk of gliomas for ipsilateral (same-side) but not contralateral (opposite-side) exposures to the head (as reflected by which hand the subject typically used to hold his/her cell phone). A 2.4-fold increase in risk was seen for acoustic neuromas due to ipsilateral exposures, whereas no increased risk occurred for meningiomas (tumors that occur in the membranes covering the brain and spinal cord).

“Clearly we need more studies of long-term cell phone usage to better assess the cancer risks,” says coauthor Michael Carlberg. Cell phones have been in mainstream usage for only a decade or so, and yet radiation-induced brain tumors normally take about 10–15 years to develop, according to the American Cancer Society.

Hardell’s research team was itself the source of several studies included in the meta-analysis. In the October 2006 issue of the *World Journal of Surgical Oncology*, the investigators reported a 70% increased risk of grade III–IV astrocytomas (highly aggressive brain tumors) for analog cell phone users. This same study found a nearly 4-fold increase in risk for acoustic neuromas after 15 years of exposure to analog cell phones.

Notably, there was no increased risk for testicular cancer, B-cell lymphoma, or salivary gland tumors, suggesting that the findings were not due to observational or recall bias, as such bias should have existed for all tumor types.

To address whether their earlier studies may have skewed the conclusions of their 2008 meta-analysis, the team omitted their own studies from the analysis and still found significantly increased risk for gliomas and nonsignificantly increased risk for acoustic neuromas (50% and 210% increases, respectively) for ipsilateral exposures. “We are now seeing a consistent pattern of increased risk for glioma and acoustic neuroma,” says coauthor Kjell Hansson Mild, a radiation physicist at Umeå University, Sweden. “Not only our own studies are showing this but also all other studies that have included at least ten years as a latency period.”

Emerging evidence suggests that children may be more vulnerable to the potential carcinogenic effects of cell phones and other microwave-emitting technologies. “Concerns about children’s potential vulnerability to RF [radiofrequency] fields have been raised because of the potentially greater susceptibility of their developing nervous systems,” says Leeka Kheifets, an epidemiology professor at the University of California, Los Angeles, and former director of the Electric Power Research Institute EMF research program. “In addition, their brain tissue is more conductive, RF penetration is greater relative to head size, and they will have a longer lifetime of exposure [although the degree of risk for any carcinogen will be primarily determined by the exact timing and magnitude of exposure].”

The importance of a thinner skull and differing dielectric properties is confirmed by a study in the 7 June 2008 issue of *Physics in Medicine and Biology* showing that a child’s brain absorbs up to twice as much RF as an adult brain. Children today will experience a longer period of exposure because they start using cell phones at an earlier age, according



In July 2008 market research firm MultiMedia Intelligence reported that more than 16 million U.S. teens use cell phones.

to Hardell; this might be important, because cumulative dose seems to have a strong influence on increased risk of brain tumors. Kheifets adds, however, that “data are lacking on effects of exposures on brain tumors in children . . . [and] other health effects need to be looked at as well.”

The wireless industry takes a cautious view of the research. “The weight of the scientific evidence and the conclusions of a large number of expert scientific reviews show that wireless phones do not pose a health risk,” says Joseph Farren, assistant vice president for public affairs with CTIA—The Wireless Association. “The industry supports continued research as technology continues to evolve, but wishes to stress the fact that there is a consensus among leading health organizations regarding published scientific research showing no reason for concern.”

Hardell concedes it is too soon to determine a safe limit for cell phone use. “Can we say that a ten-minute call is equal to ten one-minute calls?” he asks. “Until we answer such questions, we cannot establish a new limit or even state which parameters or units help define that limit. Nonetheless, since we do see an increased risk of brain tumors, it is necessary to apply the precautionary principle in this situation, especially for long-range exposures that are likely to affect children in particular.” In practice, this might involve limiting children’s use of cell phones and using speaker phones to minimize direct exposure to the head. —M. Nathaniel Mead

OCCUPATIONAL HEALTH

Lunar Lung Disease

With the National Aeronautics and Space Administration (NASA) finalizing plans to begin construction on a manned lunar outpost by 2020, the sun is rising on a whole new world of environmental and occupational health. Could longer space missions, reduced gravity, and moondust be a dangerous combination for lunar astronauts' pulmonary health? Results published in the August 2008 issue of the *European Journal of Applied Physiology* suggest so.

"Moondust has properties similar to silica, a mineral commonly encountered in mining operations known to cause silicosis and other lung problems," explains principal investigator Kim Prisk, a researcher with the Human Factors and Performance Team at the National Space Biomedical Research Institute. "To be safe we need to know how much dust can get into astronauts' airways, where it deposits, how long it stays, and just how toxic it might be." Such information is essential to mission designers who must know what air purification equipment to haul moonward and how extensive post-moonwalk decontamination procedures must be in order to clean up the clingy dust.

To determine how much and where moondust might deposit in the lungs, Prisk's team performed experiments under lunar gravity conditions during parabolic flights

aboard NASA's Microgravity Research Aircraft. Up to six subjects breathed in aerosols (104 particles/mL) of 0.5- or 1- μ m polystyrene latex beads (representative of moondust particle sizes) at a constant rate through a mouthpiece. The number of beads entering and leaving the subjects' breath was measured using a photometer, which revealed how much "dust" remained in subjects' airways. Compared with terrestrial conditions, lunar gravity reduced the total quantity of 0.5- μ m beads settling in the airways by 25% and 1- μ m beads by 32%, explains first author Chantal Darquenne, an associate professor in the Department of Medicine at the University of California, San Diego. But while this may seem like good news, further experiments showed that the beads that settled were more likely to do so in the alveoli, clearance from which may be difficult. Whereas particles would be deposited in the upper airways under terrestrial conditions, under lunar conditions they would remain available to be eventually transported deeper into the lung.

"NASA is learning that [different] moondusts have toxicologically worrisome properties including reactive surfaces, large surface areas per unit mass, a high content of particles greater than 0.1 μ m, and metallic iron impregnation," says John James, chief toxicologist at the NASA Johnson Space Center in Houston, Texas. "We must be careful not to suppose that there is one level of toxicity for lunar dust," he adds. "It is likely that there is considerable variability in

ehpnet

by Erin E. Dooley

Green Halloween

<http://www.greenhalloween.org/>

Halloween—what would it be without all the candy children pick up door to door? But much of the candy that's typically distributed at Halloween contains high amounts of *trans* fats, high-fructose corn syrup, sodium, and dyes. Green Halloween, launched in 2007 by a Seattle mother, is a grass-roots movement that encourages parents, children, schools, and communities to make Halloween a healthier and more sustainable holiday.

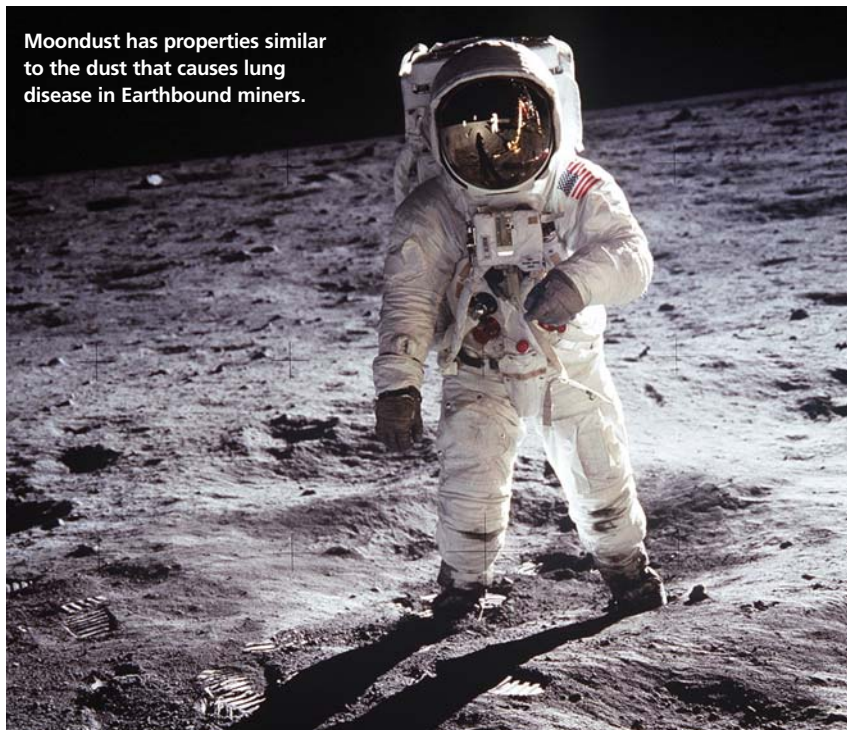
The Parents section of the Green Halloween website provides ideas on how to select affordable healthier treats to give out at Halloween—including non-candy alternatives—with an emphasis on selecting organic and locally produced items with minimal packaging. The Kids section includes ideas for alternatives to trick-or-treating for candy, among them the traditional UNICEF coin collection program as well as Reverse Trick-or-Treating, an initiative of Global Exchange that seeks to educate the public about sustainable and ethical cocoa production. The Help Out page lists other ways to celebrate Green Halloween, for example by hosting a neighborhood party and choosing decorations that use natural products and help eliminate waste.

the size distribution and mineral composition of dust from one location to another. This could mean several-fold variability in the inherent toxicity of the dusts."

"Occupational dust diseases can take decades to develop among exposed workers on Earth, but if the alveoli are more affected on the moon and clearance is reduced, disease could develop more quickly in astronauts—especially if lunar dust proves very toxic," says David Goldsmith, an associate research professor of environmental and occupational health at The George Washington University in Washington, DC. Emphasizing that we should recognize moondust-exposed astronauts as dusty trades workers in space, he points out that chronic silica exposure can also lead to lung cancer, kidney ailments, and autoimmune diseases in occupationally exposed workers on Earth. He adds, "In space and on Earth these conditions are fully preventable with proper respiratory protection including engineering controls."

This high-flying research may also have a down-to-Earth application. By determining where particles of different size settle in the airways under terrestrial gravity conditions, it may be possible to learn how to deliver drugs accurately to different areas of the lungs. —Adrian Burton

Moondust has properties similar to the dust that causes lung disease in Earthbound miners.



NASA

RESPIRATORY DISEASE

Stormy Outlook for Asthma

Conventional wisdom holds that rainy days aid asthmatics by washing away pollen pollutants that trigger attacks. But a new study shows that in some cases just the opposite is true—in a report published in the July 2008 issue of *Thorax*, the number of people seeking help at emergency rooms for asthma attacks routinely increased within hours of thunderstorms striking.

Since the 1980s, studies in Canada, Europe, and Australia have documented spikes in asthma cases after thunderstorms. The new study “confirms the association between thunderstorms and outbreaks of asthma in the largest database to date,” says Christine A. Rogers, an assistant professor of environmental health science at the University of Massachusetts, Amherst.

In the current study, a team of climatologists and epidemiologists from two Georgia universities evaluated data from 10 million emergency room visits to 41 Atlanta hospitals over the period from 1993 to 2004. Of 215,832 asthma emergency room visits, they found that 24,350 took place on the day following a thunderstorm, which worked out to about 3% more visits on days after thunderstorms than on other days.

Although a 3% rise may seem small, it could have a significant public health impact for areas with populations in the millions, says study leader Andrew Grundstein, a climatologist at the University of Georgia, Athens. Moreover, “emergency room visits represent an extreme outcome,” notes coauthor Stefanie Sarnat, an epidemiologist at Emory University. Probably many more flare-ups of asthma occurred that were not captured under the study’s criteria, because the people did not seek medical help for asthma symptoms. An average of 70 emergency room visits for asthma are recorded daily in the Atlanta area, according to Sarnat, and the region experiences an average of 50–60 days with thunderstorms.

The counter-intuitive finding of an increased risk of asthma is believed to result from pollen grains swelling and rupturing upon contact with rainwater. The released particles are tinier, more readily inhaled into the airways, and easily spread by gusty winds from thunderstorm downdrafts. “People with asthma and allergies should stay indoors during and after thunderstorms and keep medications close by,” advises Sarnat.

Reports such as a study by Robert J. Trapp and colleagues in the 11 December 2007 *Proceedings of the National Academy of Sciences* predict that rising temperatures and humidity due to global climate change could increase the frequency of severe thunderstorms, which, in turn, could aggravate asthma symptoms. “It’s important for people to know that thunderstorms are another environmental factor that can [exacerbate] asthma,” Grundstein says.

The team has applied for funding to conduct a more detailed analysis using sophisticated tools such as Doppler radar to identify key elements of thunderstorms and meteorological factors that may impact asthma, such as rainfall rates, strength of downdraft winds, and lightning. “Down the road, we may be able to develop a forecast system to warn people who are especially vulnerable to keep them out of emergency rooms,” Grundstein says. —Carol Potera

Emergency room visits for asthma symptoms rise in the hours after thunderstorms.



The Beat

by Erin E. Dooley

Toy Safety Bill Signed

In 2007, millions of toys were pulled from U.S. shelves due to high levels of lead. Legislation passed 14 August 2008 sharply limits the lead allowed in children’s products to 100 ppm, bans the use of phthalates (3 types will be permanently banned, while 3 others are suspended pending further study), and significantly increases funding and staffing for the Consumer Product Safety Commission. The law also mandates testing and safety certifications for products marketed for children ages 12 and under and requires foreign manufacturers to comply with U.S. toy safety standards.

Arctic Split

Researchers announced in September 2008 that Canada’s Markham Ice Shelf and two other large tongues of ice had split off

Fragments of the Markham Ice Shelf (left) after splitting off Ellesmere Island (right)



Ellesmere Island into the Arctic Ocean, a rate of calving the researchers say highlights the rapidity of climate-related changes occurring in the Arctic. This year, the area of floating Arctic sea ice was at its second lowest point since measurements began 30 years ago. Ice cover reflects radiation from the sun back into space, creating a cooling effect on the Earth; as the area of ice diminishes, dark seawater and ice-free land absorb radiation and could

possibly accelerate warming of the Earth. Loss of ice shelves also affects unique local ecosystems that depend on such ice.

Wastewater for Urban Gardens?

Amid rising scarcity of food and clean water alike, urban farms are an important source of fresh produce in developing countries. But the untreated wastewater used to irrigate many of these farm plots can contain heavy metals and raw sewage, putting the health of potentially hundreds of millions of people at risk. A survey of 53 cities in developing countries released in August 2008 by the International Water Management Institute finds the use of untreated wastewater on urban gardens is “widespread and practically inevitable” due to water scarcity, transport, and monitoring issues. In the study area alone, more than 1 million urban farmers provide produce for 4.5 million people.

Body Shops Go Green

Automobile body shop owners investing in new water-based paint systems and dust

PESTICIDES

Carbofuran under Review

In the 31 July 2008 *Federal Register*, the Environmental Protection Agency (EPA) published a proposal to revoke all food “tolerances” of the insecticide carbofuran—residue allowances that are allowed to appear on food—on both domestic and imported produce, based on excessive risks to children and wildlife. If approved, this reversal of a July 2006 decision to allow carbofuran tolerances on imported coffee, bananas, sugarcane, and rice would sidestep the need for all-out cancellation of the pesticide’s registration.

Carbofuran (trade name Furadan) is a restricted-use pesticide registered in the United States since 1969. The compound causes overstimulation of the nervous system by inhibiting acetylcholinesterase. Symptoms of overexposure in humans include headache, weakness, abdominal cramping, nausea, blurred vision, convulsion, tremor, and coma. Carbofuran is highly toxic to birds, fish, and bees.

The proposal to revoke tolerances was necessary to protect children, says agency spokesperson Dale Kemery, because “studies have consistently shown that juvenile rats are more sensitive to carbofuran than adult rats.” Based on EPA risk assessments, children up to age 5 also “experience the highest levels of dietary risk because they tend to eat larger amounts of food per their body weight than do teenagers or adults and because their systems for detoxifying contaminants are still developing.”

That assessment was overly conservative, argues John Cummings, regulatory manager for North America at the Agricultural Products Group of FMC Corporation, the sole U.S. manufacturer of carbofuran. Cummings says the EPA’s risk calculation includes the use of three safety factors, whereas FMC argues that the toxicologic data support a value of $100\times$ for the combination of these factors but not the $400\times$ asserted by the EPA. The three safety factors include a $10\times$

interspecies factor used to extrapolate from animal data to humans, a $10\times$ intraspecies factor used to account for possible variations between individuals, and a $4\times$ uncertainty factor that is permissible under the Food Quality Protection Act.

The EPA is only reacting to the law, Kemery says: “We are required by section 408 of the Federal Food Drug and Cosmetic Act to take into account the potential for children to be more sensitive in establishing safe levels on food—for example, by including additional safety factors in our calculations.” The American Bird Conservancy, which has fought for several years to have carbofuran banned, points out that as far back as 1980 EPA scientists had estimated that over a million birds were killed each year by the granular formulation of carbofuran, the registration for which was cancelled in 1994.

Beyond the tolerance revocation, the EPA embarked years ago on an effort to ban all U.S. sales of carbofuran by cancelling its registration altogether on the basis of dietary, occupational, and environmental considerations. This larger move has gotten support from several environmental groups. Alternatively, several U.S. grower groups and the U.S. Department of Agriculture have asked the EPA to consider alternatives to cancellation, claiming carbofuran is economically important to U.S. agriculture. About 1 million pounds are used annually on fruit and vegetable crops including corn, cotton, potatoes, sunflowers, and tobacco.

If, following the 29 September 2008 deadline for comments on the proposed action, the EPA issues a final tolerance revocation, FMC could request a hearing. If the revocation becomes law, it would become illegal to sell domestic or imported food bearing any residue of carbofuran; enforcement would be the responsibility of the Food and Drug Administration. —David Tenenbaum

removal technologies are seeing such benefits as lower operating costs, improved air quality, and better worker health. The new paints, which consume fewer solvents and energy as well as speed up the painting process, will be mandatory in California at the end of 2008. In January 2008, the U.S. EPA announced new rules requiring body shops to minimize emissions of paint-stripping chemicals and improve ventilation of workspaces and application equipment, requirements that are

expected to reduce pollutant emissions by almost 7,000 tons annually.

Concrete Data on Hg Emissions

Cement manufacturing often uses fuels and raw materials with high mercury content, which is vaporized and emitted through smokestacks. In July 2008, the advocacy groups Earthjustice and the Environmental Integrity Project released a report examining new EPA data that show unregulated mercury emissions from cement kilns to be nearly twice as high as the agency estimated in 2006—almost 23,000 pounds of mercury released annually from more than 150 plants. In some cases cement plants are among the worst mercury polluters in states, surpassing coal-fired power plants. The report calls on the EPA to enact a mercury standard for kilns.

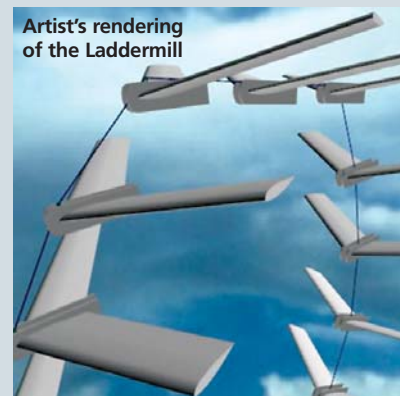
High-Flying Energy Source

Research teams around the world are working to tap the energy potential of high-altitude winds, a more abundant and reliable energy source than the ground-level winds upon

which conventional turbines rely. In an August 2008 proof of concept experiment at the Delft University of Technology, researchers flying a 10-m^2 kite successfully generated enough electricity to power 10 homes; they believe a full-scale version of the “Laddermill” rig could power some 100,000 homes. Northwestern European countries are thought to be best positioned geographically to take advantage of the high-speed jet stream.



Going clean could pay off for body shops



Artist's rendering of the Laddermill